

Todd Hill Wind Farm, Morpeth, Northumberland

geophysical surveys – phase 2

on behalf of

Arcus Renewable Energy Consulting Ltd

Report 2117
November 2008

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1. Summary

The project

- 1.1 This report presents the results of further geophysical surveys conducted in advance of a proposed wind farm development at Todd Hill, near Morpeth, in Northumberland. This second programme of survey covered three additional areas totalling 4ha.
- 1.2 The works were again commissioned by Arcus Renewable Energy Consulting Ltd and conducted by Archaeological Services Durham University.

Results

- 1.3 Probable ring-ditches, which could indicate the presence of roundhouses, and possible enclosure ditches were identified in Area 5/5a, on a small plateau. Anomalies within the possible roundhouses could reflect hearths and pits or postholes. These features may comprise a small late prehistoric settlement of the type often investigated by Jobey in the last century.
- 1.4 Traces of former ridge and furrow cultivation were identified in Areas 2/2a, 3, 4 and 5/5a.
- 1.5 Discrete soil-filled pit and ditch features may also have been detected in Areas 3, 4, 5/5a and 6.

2. Project background

Location (Figures 1 & 2)

- 2.1 The study area was located at Todd Hill, near Pigdon, about 5km north-west of Morpeth in Northumberland (NGR centre: NZ 1545 8940). Three surveys were conducted for this second phase of survey, totalling approximately 4ha. One survey, Area 5a, extended the earlier Area 5 survey while Areas 1a and 2a were conducted in the east of the proposed development area to reflect changes in the proposed site layout. The locations and results of both phases of survey are provided in this report.

Development proposal

- 2.2 The proposed development is a wind farm of four turbines, access tracks and associated infrastructure.

Objective

- 2.3 The principal aim of the surveys was to assess the nature and extent of any sub-surface features of potential archaeological significance within the proposed development area, so that an informed decision may be made regarding the nature and scope of any further scheme of archaeological works that may be required in advance of development.
- 2.4 The first phase of survey identified a number of probable features of archaeological significance in the north-western part of the proposed development (Archaeological Services 2008). This, together with a change to the layout of the eastern part of the proposed development, prompted this second phase of survey.

Methods statement

- 2.5 The surveys have been undertaken in accordance with instructions provided by Arcus Renewable Energy Consulting Ltd, based on current English Heritage (2008) guidelines and discussions with the Conservation Team at Northumberland County Council.

Dates

- 2.6 Fieldwork was undertaken between 5th and 7th November 2008. This report was prepared between 10th and 27th November 2008.

Personnel

- 2.7 Fieldwork was conducted by Richie Villis (Supervisor), Duncan Hale and Jason Mole. This report was prepared by Duncan Hale, the Project Manager, with illustrations by David Graham and Janine Wilson.

Archive/OASIS

- 2.8 The site code is **MTH08-2**, for **Morpeth, Todd Hill 2008 phase 2**. The survey archive will be supplied on CD to the client for deposition with the project archive in due course. Archaeological Services is registered with the Online

Access to the Index of archaeological investigations project (OASIS). The OASIS ID number for this project is **archaeol3-51983**.

3. Archaeological and historical background

- 3.1 An archaeological desk-based assessment of the proposed development area and its environs was conducted by ASWYAS (2008). The conclusions of that report are as follows:

“It is probable that the proposed development site has remained in use as mixed agricultural land since at least the medieval period. The existing field pattern within the site is a product of post-medieval enclosure, although the curvilinear alignment of the field boundaries probably reflects the influence of earlier medieval land divisions. Apart from agricultural activity, and some minor quarrying, there is no archaeological evidence for previous activity within the proposed development site. However, no archaeological survey or excavation has been undertaken on the site, and it is possible that sub-surface features or deposits that pre-date the medieval period could survive in the area” (ASWYAS 2008, 9).

- 3.2 The only known prehistoric sites nearby comprise two Iron Age settlements with c.5km of the study site (ASWYAS 2008, 4). There are no known Roman or early medieval sites within the desk-based study area (ASWYAS 2008, 5).
- 3.3 There is the site of a deserted medieval village at Pigdon just to the south and several fields around there contain upstanding remains of ridge and furrow earthworks. To the east lies the village of Stanton, where a number of medieval and post-medieval structures and features survive.
- 3.4 Recent geophysical survey by Archaeological Services (2008) identified a number of probable archaeological features, particularly in the north-western part of the proposed development. These features included ring-ditches with internal features, which could reflect the remains of roundhouses, and possible enclosure ditches as well as traces of ridge and furrow and occasional other soil-filled features.

4. Landuse, topography and geology

- 4.1 At the time of survey the proposed development area comprised five fields of pasture and one ploughed field.

Area	Size (ha)	Landuse	Topography	NGR
1	0.68	pasture	flat	NZ 161 893
1a	0.68	pasture	flat	NZ 161 894
2	0.48	pasture	flat	NZ 159 893
2a	0.44	pasture	flat	NZ 159 894
3	1.52	pasture	gently sloping	NZ 156 894

4	1.84	pasture	gently sloping	NZ 155 891
5	1.52	pasture	steep slope to south	NZ 154 895
5a	3.20	pasture	steep slope to south	NZ 152 895
6	1.00	arable (ploughed)	gently sloping west	NZ 152 893

- 4.2 The surveys were mainly on the upper western slopes of the hill at between 100-120m OD.
- 4.3 The underlying solid geology of the area comprises the Namurian 'Millstone Grit Series', which is overlain by Boulder Clay and morainic drift.

5. Geophysical survey

Standards

- 5.1 The surveys and reporting were conducted in accordance with English Heritage guidelines *Geophysical survey in archaeological field evaluation, 2nd edition* (David, Linford & Linford 2008); the Institute of Field Archaeologists Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2002).

Technique selection

- 5.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a variety of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar and electromagnetic survey. Some techniques are more suitable than others in particular situations, depending on a variety of site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.
- 5.3 In this instance it was considered likely that cut features such as ditches and pits might be present on the site, and that other types of feature such as trackways, wall foundations and fired structures (for example kilns and hearths) might also be present.
- 5.4 Given the anticipated shallowness of targets and the non-igneous geological environment of the study area a geomagnetic technique, fluxgate gradiometry, was considered appropriate for detecting the types of feature mentioned above. This technique involves the use of hand-held magnetometers to detect and record anomalies in the vertical component of the Earth's magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect archaeological features.

Field methods

- 5.5 Three survey areas were specified for this second phase of works: Area 5a was an extension to the earlier Area 5; Areas 1a and 2a were surveyed to the north of the original Areas 1 and 2 to reflect a change in the proposed development.
- 5.6 A 20m grid was established at each survey location and tied-in to known, mapped Ordnance Survey points using a Leica GS50 global positioning system.
- 5.7 For the Phase 2 surveys, measurements of vertical geomagnetic field gradient were determined using Geoscan Research FM256 fluxgate gradiometers. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was set to 0.1nT, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 1600 sample measurements per 20m grid unit.
- 5.8 Data were downloaded on site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

- 5.9 Geoplot v.3 software was used to process the geophysical data and to produce both continuous tone greyscale images and trace plots of the raw (unfiltered) data. The greyscale images and interpretations are presented in Figures 2-8; the trace plots are provided in Figure 9. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. A palette bar relates the greyscale intensities to anomaly values in nanoTesla.

- 5.10 The following basic processing functions have been applied to each dataset:

<i>clip</i>	clips, or limits data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic.
<i>zero mean traverse</i>	sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities.
<i>destagger</i>	corrects for displacement of anomalies caused by alternate zig-zag traverses.
<i>interpolate</i>	increases the number of data points in a survey to match sample and traverse intervals. In this instance the data have been interpolated to 0.25 x 0.25m intervals.

Interpretation: anomaly types

- 5.11 Colour-coded geophysical interpretation plans are provided for each survey area. Three types of geomagnetic anomaly have been distinguished in the data:
- | | |
|--------------------------|---|
| <i>positive magnetic</i> | regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic |
|--------------------------|---|

	susceptibility soil-filled structures such as pits and ditches.
<i>negative magnetic</i>	regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings and other concentrations of sedimentary rock or voids.
<i>dipolar magnetic</i>	paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths.

Interpretation: features

General comments

- 5.12 Colour-coded archaeological interpretation plans are provided.
- 5.13 Except where stated otherwise in the text below, positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, typically sediments in cut archaeological features (such as furrows, ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning.
- 5.14 Series of parallel, weak, positive magnetic anomalies, which almost certainly reflect traces of former ridge and furrow cultivation have been detected in Areas 2/2a, 3, 4 and 5/5a.
- 5.15 Small, discrete dipolar magnetic anomalies have been detected in all of the survey areas. These almost certainly reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments, and in most cases have little or no archaeological significance. A sample of these is shown on the geophysical interpretation plans, however, they have been omitted from the archaeological interpretation plans and the following discussion.

Areas 1 & 1a

- 5.16 A number of small dipolar magnetic anomalies almost certainly reflect fired brick or ferrous waste.

Areas 2 & 2a

- 5.17 A large, intense dipolar magnetic anomaly detected crossing both these areas just east of centre almost certainly reflects a ferrous pipe.
- 5.18 Weak linear positive magnetic anomalies relating to traces of former ridge and furrow, or other former ploughing, have been detected in the western parts of both surveys.

Area 3

- 5.19 Weak linear positive magnetic anomalies detected broadly northeast-southwest across the survey area are likely to reflect former ridge and furrow cultivation.

Area 4

- 5.20 Weak linear negative and positive magnetic anomalies aligned broadly northeast-southwest across the survey area are likely to reflect former ridge and furrow cultivation.
- 5.21 Partial grids along the western edge of the survey area are due to an overgrown gorse field boundary.
- 5.22 A linear weak positive magnetic anomaly was detected running broadly north south along the field boundary at the west edge of the site. This reflects a farmers track and earthwork ridge running along that field boundary.
- 5.23 The line of dummy readings and strong dipolar magnetic anomalies aligned broadly east-west through the centre of this area correspond to a ferrous field boundary.
- 5.24 Strong dipolar anomalies at the extreme south of the survey area reflect a metal-fenced sheep pen.
- 5.25 A few small positive magnetic anomalies could reflect soil-filled pits.

Areas 5 & 5a

- 5.26 Small unsurveyed areas here correspond to boggy ground and tall vegetation.
- 5.27 A number of linear positive magnetic anomalies are apparent, orientated both north-south and east-west. These are likely to correspond to soil-filled features such as ditches, and could represent parts of former enclosures.
- 5.28 There are several, possibly up to ten, curvilinear positive magnetic anomalies in the central part of the survey, situated on a small broad plateau. These ring-shaped anomalies are likely to reflect soil-filled ditch features, possibly the construction cuts for roundhouses. Inside these ring-ditches are a number of small positive magnetic and dipolar magnetic anomalies, which probably reflect hearths or pits/postholes. This potential settlement appears to be very similar in character to other known, small, late prehistoric unenclosed settlements, relatively common in Northumberland, many of which were excavated by George Jobey in the 1960s and 1970s.
- 5.29 The central part of this survey contains a series of weak linear positive and negative magnetic anomalies which are likely to reflect former ridge and furrow. The quieter areas to the north and south do contain further possible ditch and/or drain features but may have been subject to different former landuse or more recent ploughing activity, which has removed traces of earlier activity.

Area 6

- 5.30 A linear positive magnetic anomaly detected in the east of the survey area could relate to a soil-filled cut feature, such as a ditch.

6. Conclusions

- 6.1 Eleven hectares of geomagnetic survey have now been undertaken in two phases at Todd Hill, near Morpeth, prior to the proposed construction of a wind farm.
- 6.2 Probable ring-ditches, which could indicate the presence of roundhouses, and enclosure ditches were identified in Area 5/5a, on a small plateau. Anomalies within the possible roundhouses could reflect hearths and pits or postholes. These features may comprise a small late prehistoric settlement of the type often investigated by Jobey in the last century.
- 6.3 Traces of former ridge and furrow cultivation were identified in Areas 2/2a, 3, 4 and 5/5a.
- 6.4 Discrete soil-filled pit and ditch features may also have been detected in Areas 3, 4, 5/5a and 6.

7. Sources

- Archaeological Services 2008 *Todd Hill Wind Farm, Morpeth, Northumberland, geophysical surveys*. Unpublished report **2108** for Arcus Renewable Energy Consulting Ltd, Archaeological Services Durham University
- ASWYAS 2008 *Land at Todd Hill, near Pigdon, Northumberland: Archaeological Desk-based Assessment*. Unpublished ASWYAS report **1871** for Arcus Renewable Energy Consulting Ltd.
- David, A, Linford, N, & Linford, P, 2008 *Geophysical survey in archaeological field evaluation, 2nd edition*, English Heritage
- Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*, Technical Paper **6**, Institute of Field Archaeologists
- Schmidt, A, 2002 *Geophysical Data in Archaeology: A Guide to Good Practice*, Archaeology Data Service, Arts and Humanities Data Service



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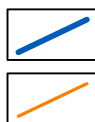
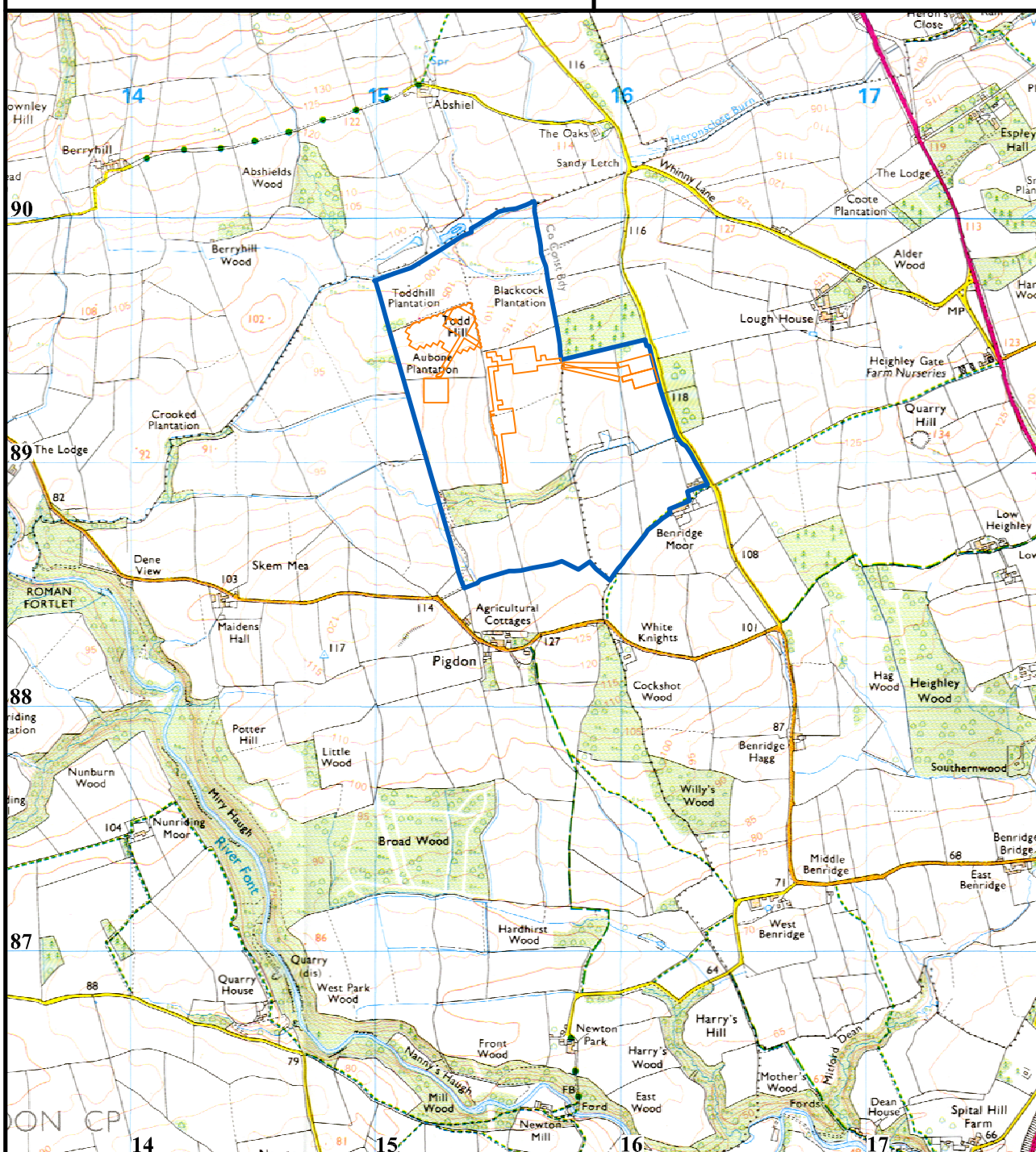
Figure 1

Study area

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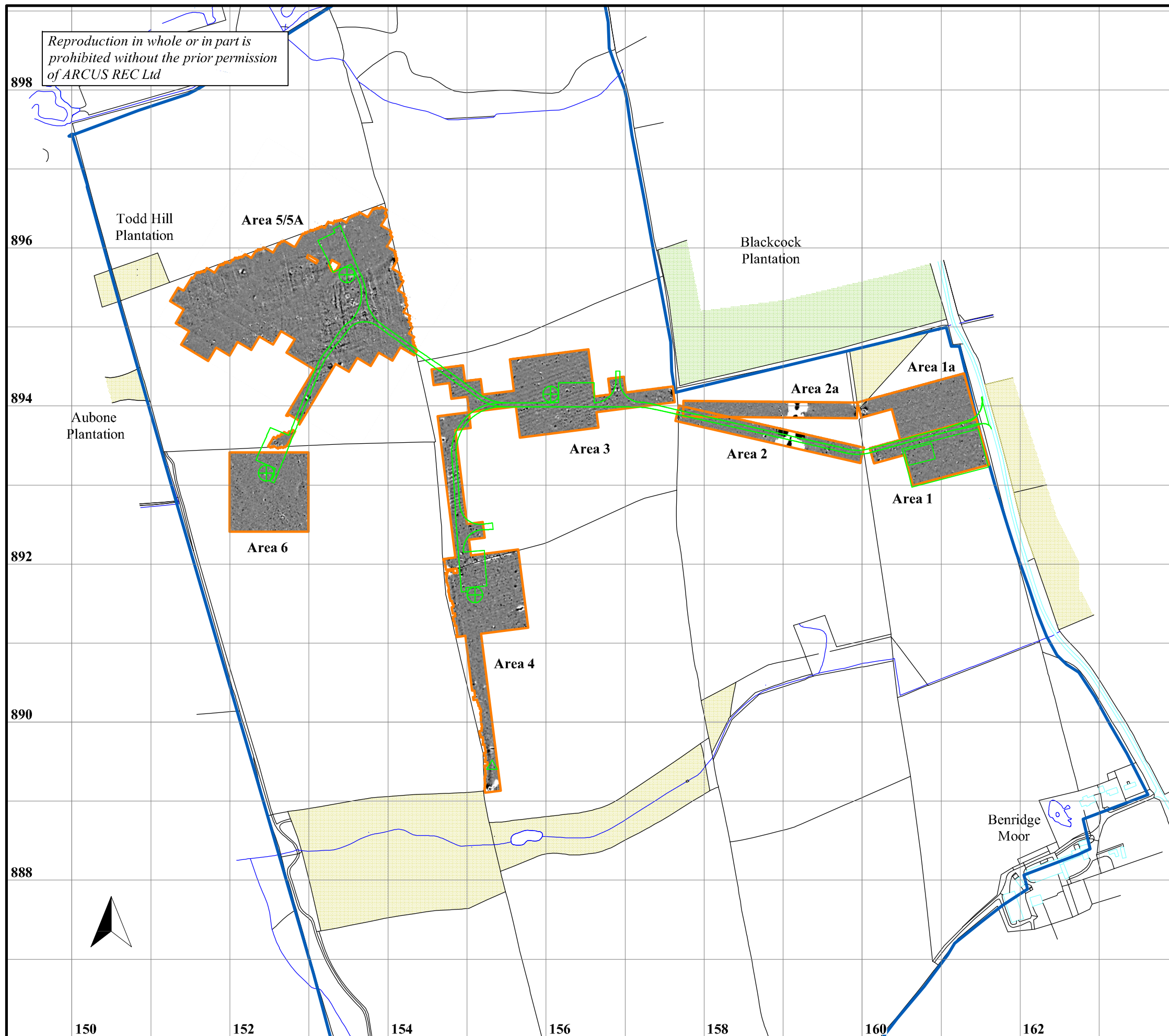


proposed development area

location of geophysical surveys

0 1km
scale 1:25 000 - for A4 plot





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Figure 2

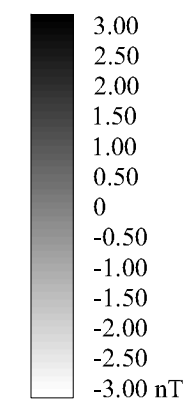
Survey locations

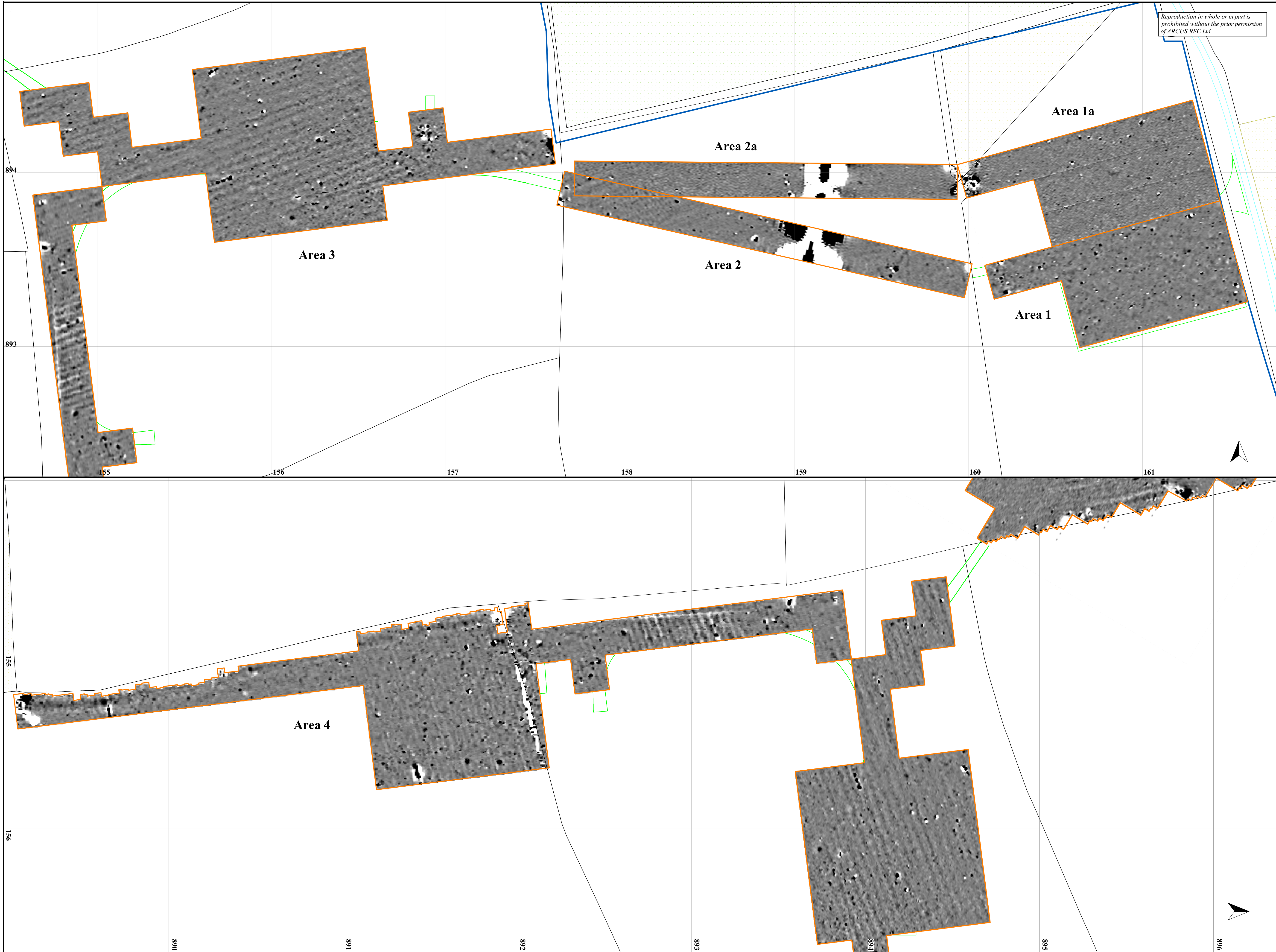
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0 250m
scale 1:5000 - for A3 plot

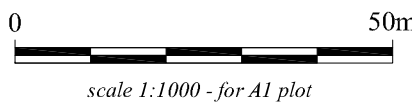
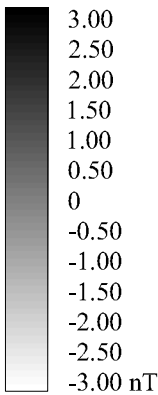
-  proposed development area
-  survey area
-  proposed development





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- development area
- survey area
- proposed development



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Figure 3

Geophysical surveys, Areas 1-4

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896

895

894

893

892

151

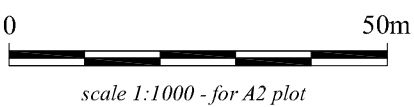
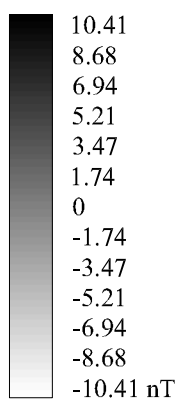
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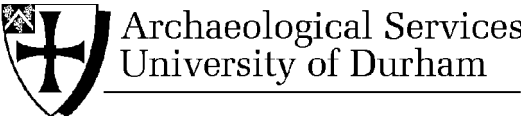
Area 5/5A

Area 6

- development area
- survey area
- proposed development



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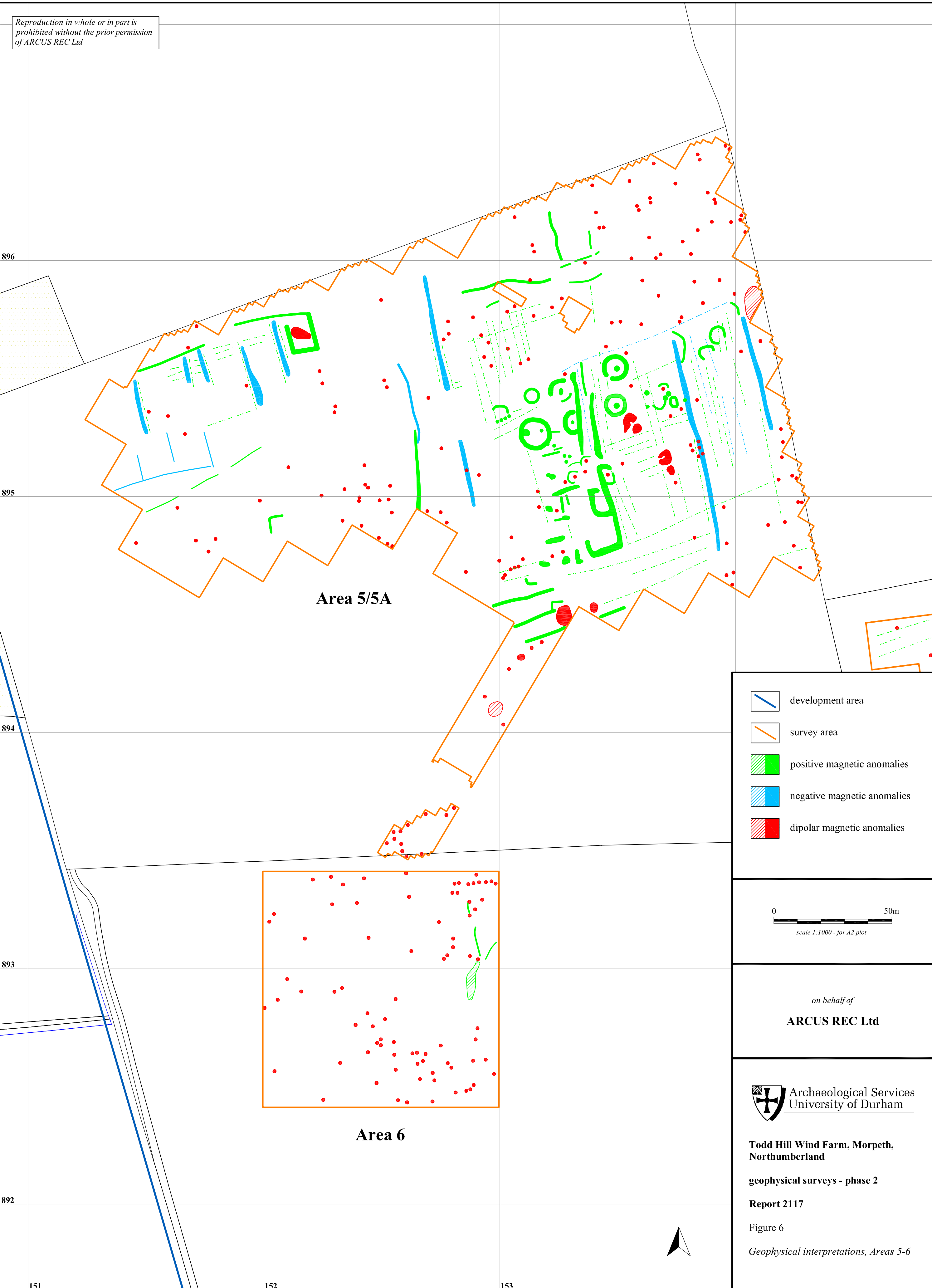
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Figure 4

Geophysical surveys, Areas 5-6







development area

survey area

positive magnetic anomalies

negative magnetic anomalies


dipolar magnetic anomalies

0 50m

scale 1:1000 - for A2 plot

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University of Durham

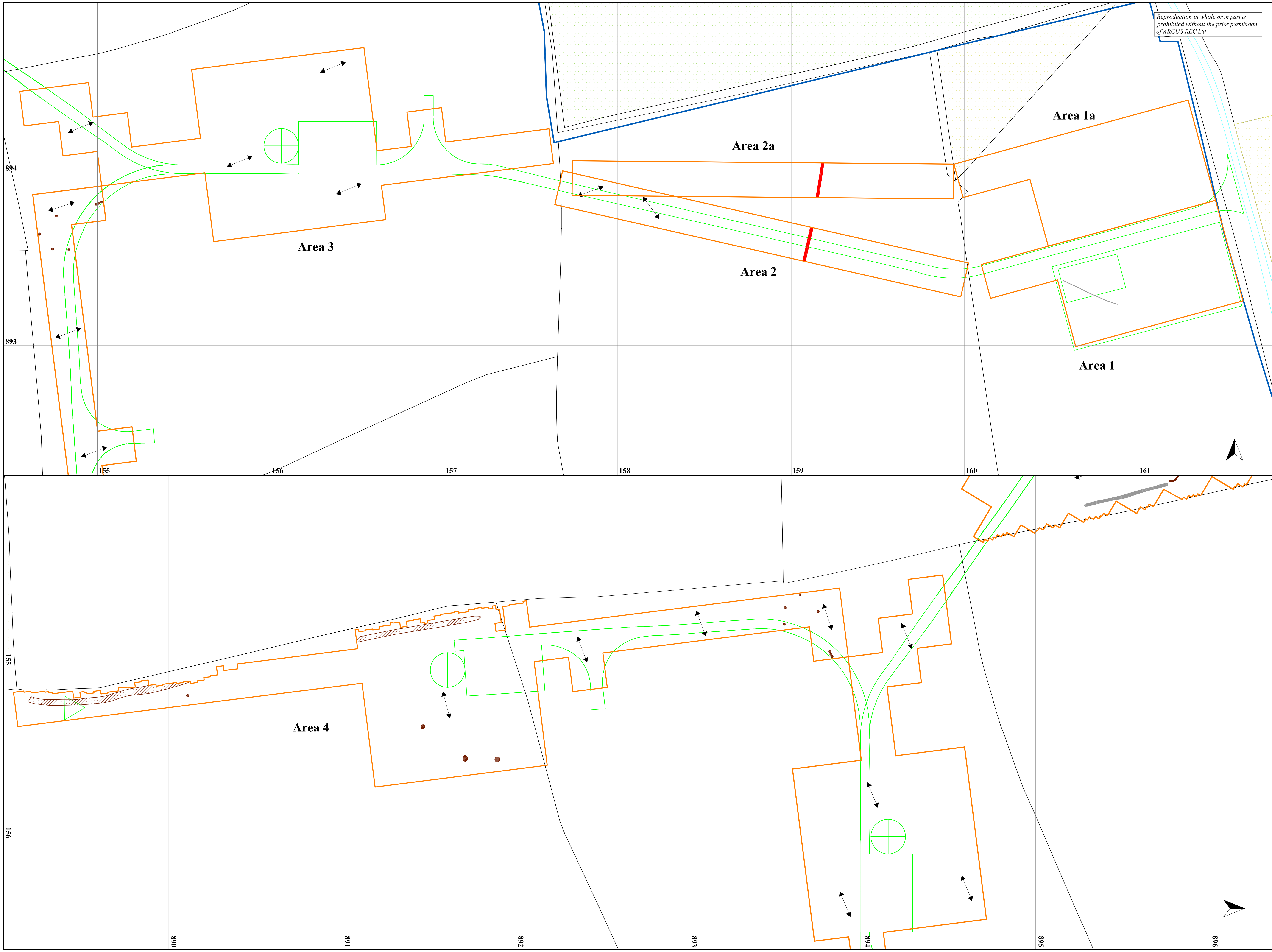
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Figure 6

Geophysical interpretations, Areas 5-6



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- development area
- proposed development
- survey area
- soil-filled features
- service pipes
- orientation of ridge and furrow

0 50m
scale 1:1000 - for A1 plot

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Figure 7
Archaeological interpretations, Areas 1-4



- development area
- proposed development
- survey area
- soil-filled features
- service pipes
- orientation of ridge and furrow

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scale 1:1000 - for A2 plot

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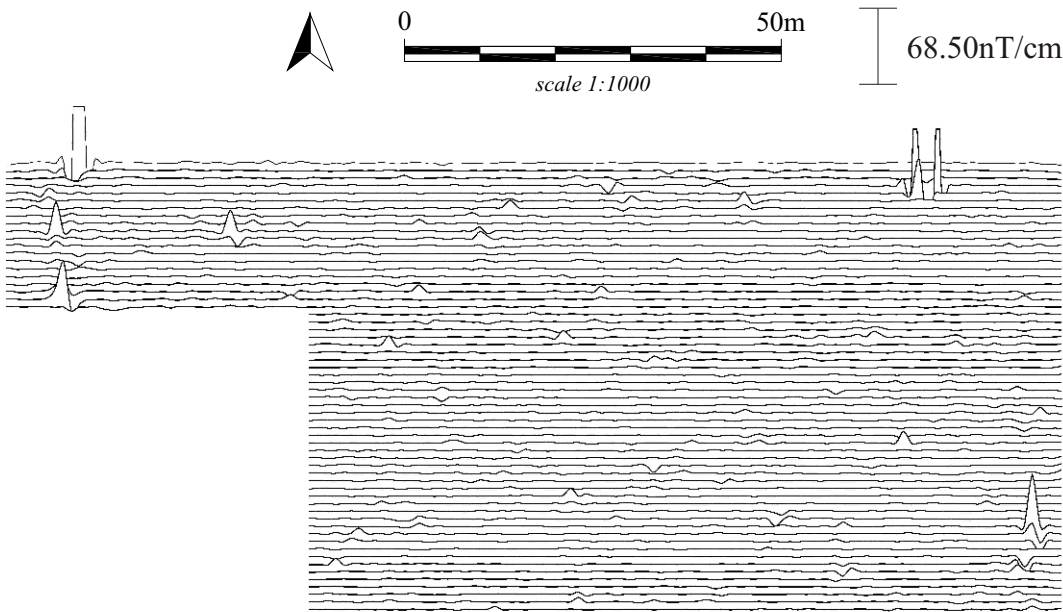
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Figure 8

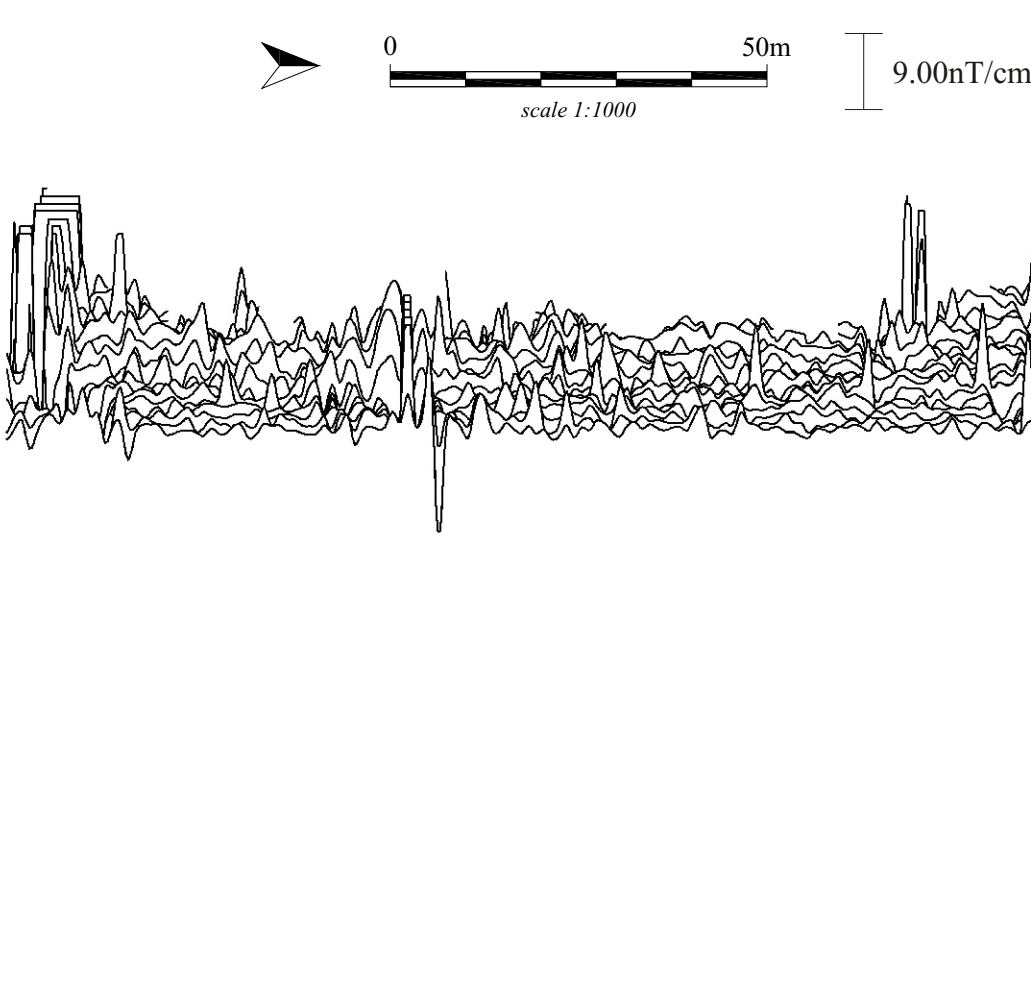
*Archaeological interpretations, Areas
5-6*

Figure 9: Trace plots of geomagnetic data

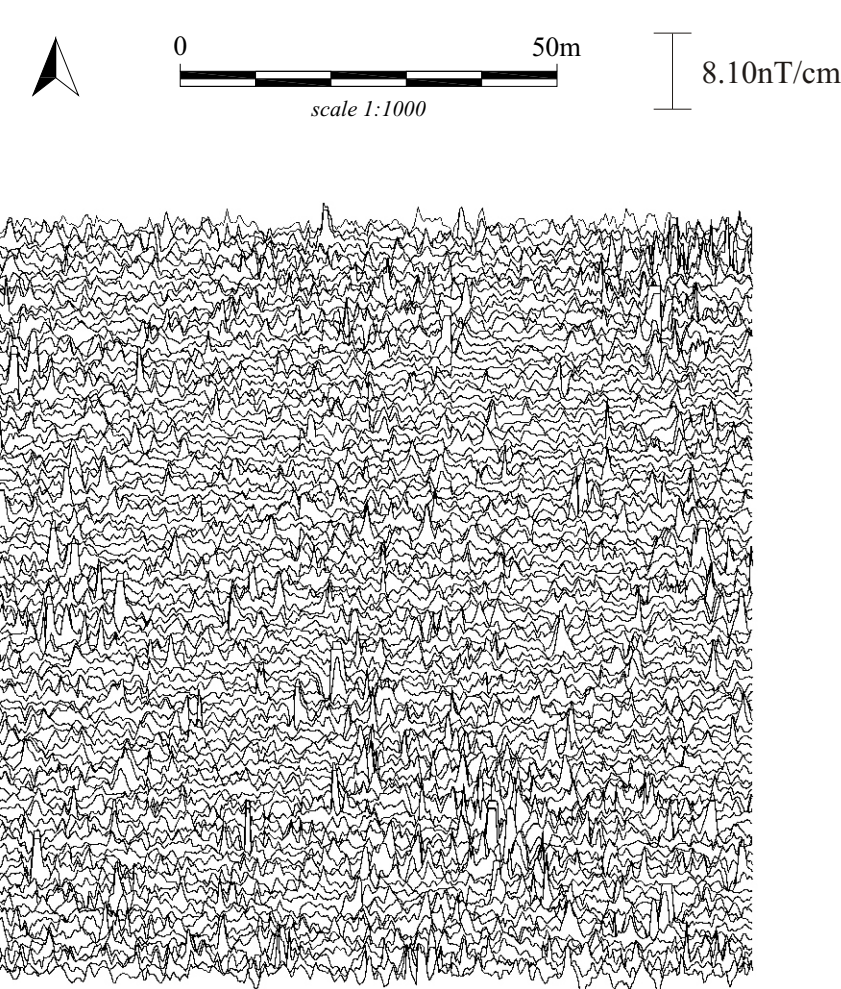
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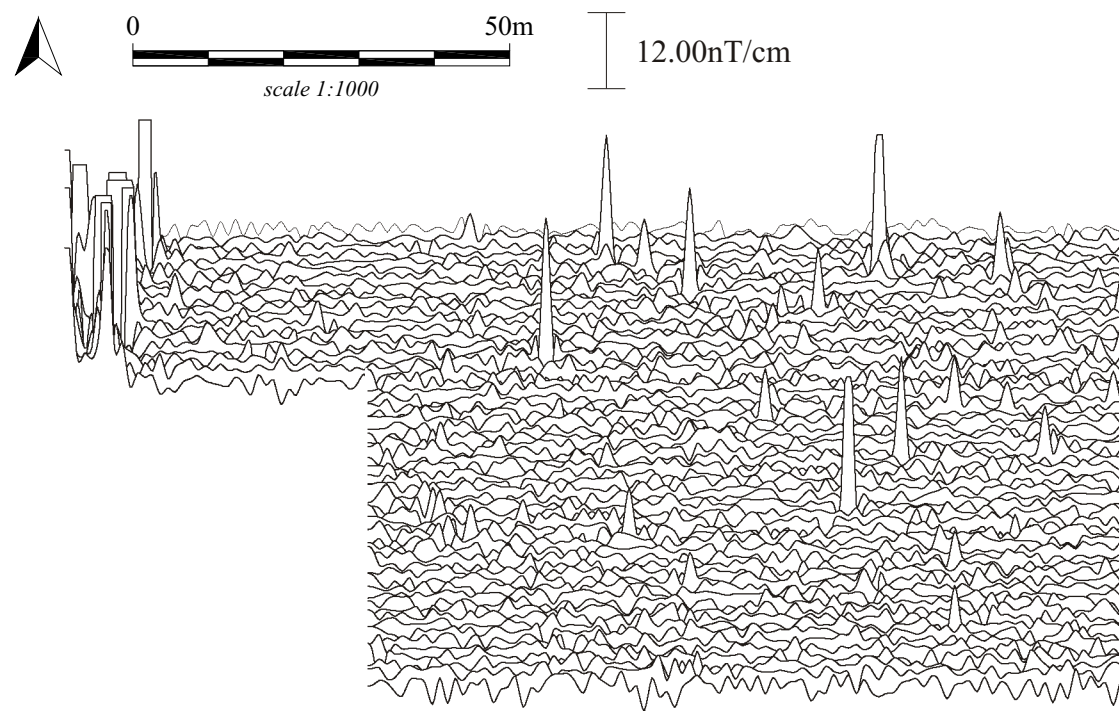
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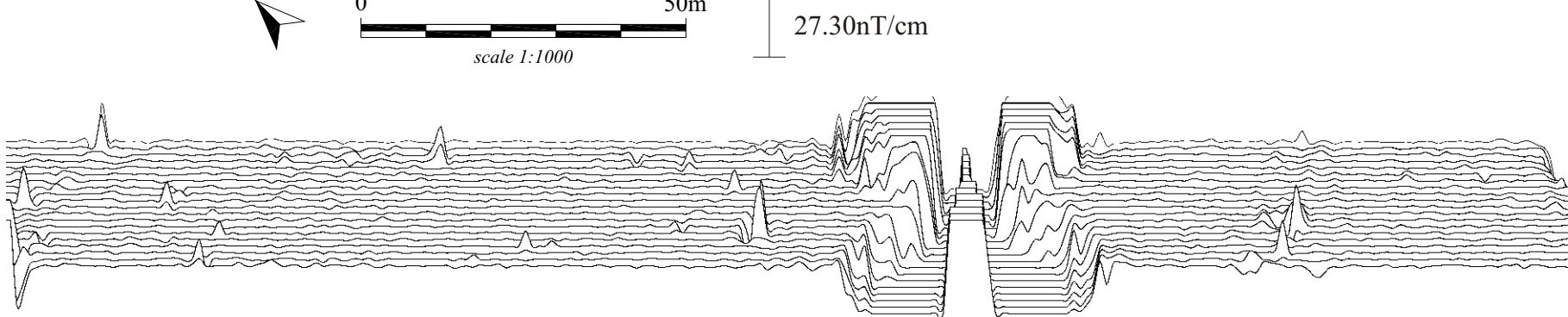
Area 6



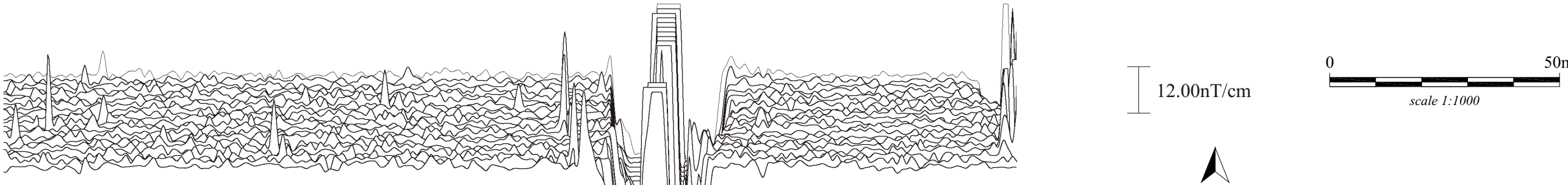
Area 1a



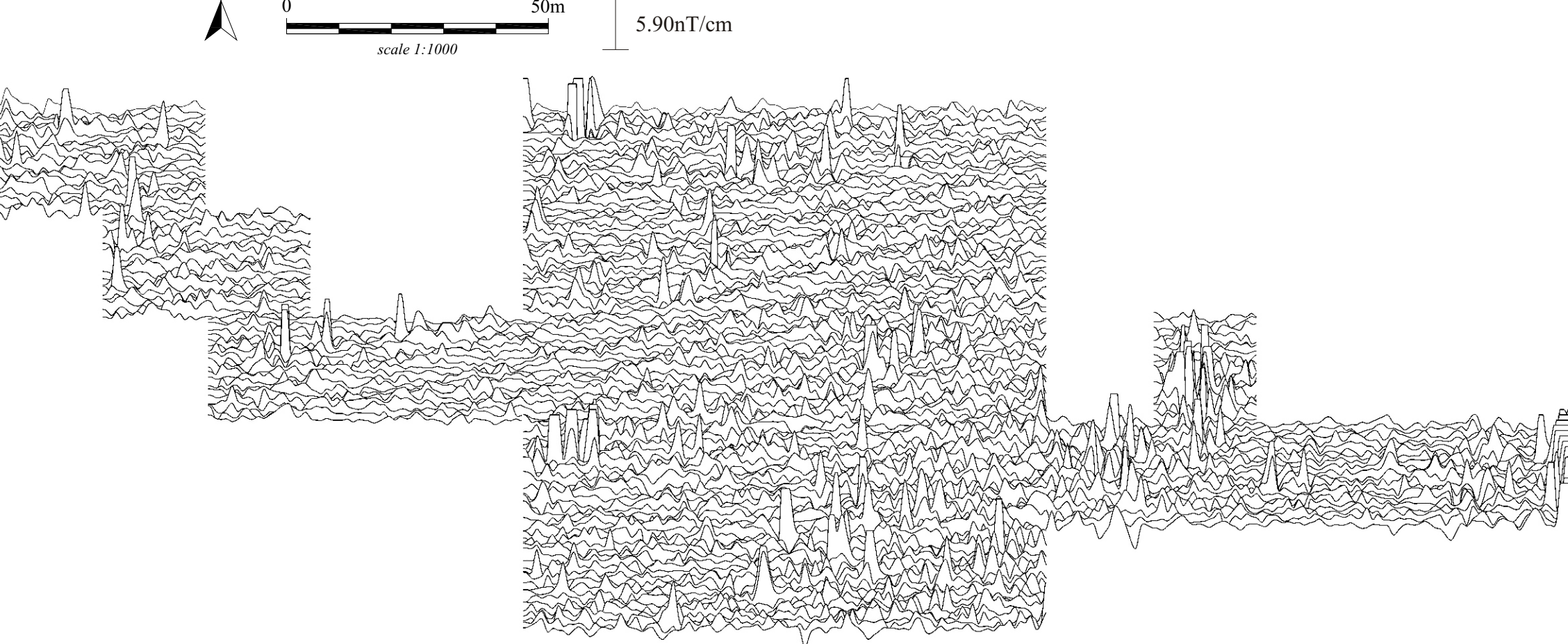
Area 2



Area 2a



Area 3



Area 5/5A

